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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/711,897	10/12/2004	Haining Yang	FIS920040194US1	5896
29371	7590	11/16/2005	EXAMINER	
CANTOR COLBURN LLP 55 GRIFFIN ROAD SOUTH BLOOMFIELD, CT 06002			THOMAS, TONIAE M	
			ART UNIT	PAPER NUMBER
			2822	

DATE MAILED: 11/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/711,897

Applicant(s)

YANG ET AL.

Examiner

Toniae M. Thomas

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 October 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) 8-10 and 13-24 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7, 11 and 12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 October 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>10/12/04; 11/01/04; 01/17/05; 04/14/05</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This action is a first Office action on the merits of Application Serial No. 10/711,897. Currently, claims 1-24 are pending.

Election/Restrictions

2. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-12, drawn to a process of making, classified in class 438, subclass 199.
- II. Claims 13-24, drawn to a product, classified in class 257, subclass 369.

3. The inventions are distinct, each from the other because of the following reasons: Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the product as claimed can be made by another and materially different process. For example, the claimed process recites the limitation "wherein said first and said second configurations of insulating material are formed subsequent to a silicidation of the CMOS devices and prior to formation of a first interlevel dielectric material over the CMOS devices. In another and

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materially different process the step of forming a first interlevel dielectric material is not required to form the product as claimed.¹

4. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

5. During a telephone conversation with James J. Cioffi on 19 October 2005 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-12. Applicant in replying to this Office action must make affirmation of this election. Claims 13-24 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

6. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Restriction of Species

7. This application contains claims directed to the following patentably distinct species of the claimed invention of Group I:

¹ The implied structure of claim 13 as it is currently presented does not require an ILD dielectric material.

- A. The embodiment of Figs 8 or 9 (claims 5-7, 12).
- B. The embodiment of Fig. 10 (claim 8).
- C. The embodiment of Fig. 11 (claim 9).
- D. The embodiment of Fig. 12 (claim 10).

8. Applicant is required under 35 U.S.C. 121 to elect a single disclosed species for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, claims 1-4 and 11 are generic.

9. Applicant is advised that a reply to this requirement must include an identification of the species that is elected consonant with this requirement, and a listing of all claims readable thereon, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

10. Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

11. Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of

the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

12. During a telephone conversation with James J. Cioffi on 03 November 2005 a provisional election was made without traverse to prosecute the invention of species A, claims 5-7 and 12. Applicant in replying to this Office action must make affirmation of this election. Claims 8-10 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected species.

13. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Information Disclosure Statement

14. As of the date of this action, an information disclosure statement (IDS) has been filed in the current application corresponding to the following dates: (1) 12 October 2004, (2) 01 November 2004, (3) 17 January 2005, and (4) 14 April 2005. Since each of the references cited in the fourth IDS filed on 14 April 2005 are cited in a previously filed IDS, the IDS filed on 14 April 2005 has not been considered. The first, second, and third IDS, however, have been considered, and a copy of each considered IDS is attached hereto.

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The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

15. Claims 2-7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The phrase "said second configuration of insulating devices" lacks antecedent basis.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

16. Claims 1-3, 5, 11, 12 are rejected under 35 U.S.C. 102(b) as being anticipated by En et al. (US 6,573,172 B1).²

The En et al. patent (En) discloses a method for forming complementary metal oxide semiconductor (CMOS) devices (figs. 2A-2I and accompanying text). The method comprises: forming a first configuration of insulating material over a first group of the CMOS devices 102 (fig. 2H); and forming a second configuration of insulating material over a second group of the CMOS devices

² The Applicant submitted the En et al. patent as prior art.

104 (fig. 2H);³ wherein the first and the second configurations of insulating material are formed subsequent to a silicidation of the CMOS devices (fig. 2A; col. 6, lines 17-22; and col. 6, lines 22-26) and prior to formation of a first interlevel (ILD) dielectric material 172 over the CMOS devices (fig. 2I and col. 7, line 65 - col. 8, line 2).

The first configuration further comprises at least a pair of individual insulating layers 140, 150 (fig. 2H; col. 6, lines 65-67; and col. 7, lines 7-11), and the second configuration of insulating devices further comprises a single insulating layer 130 (fig. 2H and col. 6, lines 38-41).⁴

The first group of the CMOS devices 102 comprises NFET devices (col. 6, lines 12-18) and the second group of the CMOS devices 104 comprises PFET devices (col. 6, lines 12-18).

The pair of individual insulating layers further comprises a first nitride layer 150 and an oxide layer 140 (col. 6, lines 65-67 and col. 7, lines 7-11), and the single insulating layer further comprises a second nitride layer 130 (col. 6, lines 38-41).

The first configuration of insulating material over the first group 102 further comprises one of a single nitride layer 150 and a single oxide layer 140 (fig. 2H); and the second configuration of insulating material over the second

³ While only two devices are shown, it is inherent that the CMOS device comprises a first group of devices and a second group of devices, since CMOS devices typically comprise a group of NMOS devices and a group of PMOS devices.

group 104 further comprises one of a single nitride layer 130, a single oxide layer 140, and a combination of a nitride and an oxide layer 130, 140 (fig. 2H).

The first configuration of insulating material comprises a compressive material 150 (col. 7, lines 7-11) and the second configuration of insulating material comprises a tensile material 130 (col. 6, lines 45-48).

17. Claims 1, 2, 5, 6, and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by En et al.

As discussed above, En discloses a method for forming complementary metal oxide semiconductor (CMOS) devices (figs. 2A-2I and accompanying text). The method comprises: forming a first configuration of insulating material over a first group of the CMOS devices 104 (fig. 2H); and forming a second configuration of insulating material over a second group of the CMOS devices 102 (fig. 2H); wherein the first and the second configurations of insulating material are formed subsequent to a silicidation of the CMOS devices (fig. 2A; col. 6, lines 17-22; and col. 6, lines 22-26) and prior to formation of a first interlevel (ILD) dielectric material 172 over the CMOS devices (fig. 2I and col. 7, line 65 - col. 8, line 2).

The first configuration further comprises at least a pair of individual insulating layers 130, 140 (fig. 2H; col. 6, lines 45-48; and col. 6, lines 65-67),

⁴ The transitional term "comprising" is inclusive or open-ended and does not exclude additional, unrecited elements (MPEP 2111.03). Thus, the claim language does not preclude the second configuration comprising other layers in addition to the single insulating layer 130.

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and the second configuration of insulating devices further comprises a single insulating layer 150 (fig. 2H and col. 7, lines 7-11).

The pair of individual insulating layers further comprises a first nitride layer 130 (col. 6, lines 45-48) and an oxide layer 140 (col. 6, lines 65-67), and the single insulating layer further comprises a second nitride layer 150 (col. 7, lines 7-11).

The first nitride layer 130 is a tensile nitride layer (col. 6, lines 45-48), and the second nitride layer 150 is a compressive nitride layer (col. 7, lines 7-11).

The first configuration of insulating material over the first group 104 further comprises one of a single nitride layer 130 and a single oxide layer 140; and the second configuration of insulating material over the second group 102 further comprises one of a single nitride layer 150, a single oxide layer 140, and a combination of a nitride 150 and an oxide layer 140.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

18. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over En et al. in view of Ku (US 6,455,405 B1).

Whether the NMOS transistors are taken to be the first group of devices and the PMOS transistors taken to be the second group of devices or vice versa, En does not teach that the first group of the CMOS devices comprises gate oxide thicknesses of a first range and the second group of the CMOS devices comprises gate oxide thicknesses of a second range.

Ku discloses a method of forming a semiconductor device, wherein the device comprises a first device region 15 and a second device region 17 (figs. 1-5 and accompanying text). The first device region 15 comprises a gate oxide 30 of a first thickness range (fig. 5 and col. 2, lines 60-62), whereas the second device region 17 comprises a gate oxide 32 of a second thickness range (fig. 5 and col. 2, lines 62-64).

En and Ku are from the same field of endeavor, fabrication methods for semiconductor integrated circuit devices. Thus, the teaching for which Ku is relied upon in this action would have been recognized in the primary prior art reference to En by one of ordinary skill in the art at the time the invention was made.

Depending on the application, CMOS devices often require dual thickness gate oxide layers, wherein the CMOS devices include a first group of devices comprising gate oxides of a first thickness range and include a second group of devices comprising gate oxides of a second thickness range (e.g. dynamic random access memory (DRAM) devices). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify

En by forming the gate oxides of the first and second group of devices, as taught by Ku, because the resulting device comprises dual thickness gate oxide layers, wherein a first group of devices comprises gate oxides of a first thickness range and a second group of devices comprises gate oxides of a second thickness range.

19. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over En et al. in view of Mizuno et al. (2002/0197890 A1) and Wolf et al. ("Chemical Vapor Deposition of Amorphous and Polycrystalline Films," *Silicon Processing for the VLSI Era - Vol. 1: Process Technology*).

Both nitride layers 130 and 150 are deposited by plasma enhanced CVD, wherein a silane (SiH_4) precursor is used (). While En discloses that the nitride layer 130 is a tensile nitride layer, En does not disclose depositing the first nitride layer using a BTBAS (BisTertiaryButylAminolsilane) precursor. In addition, En does not teach that the oxide layer 140 is TEOS.

The Mizuno et al. pre-grant published application (Mizuno) discloses a method for depositing a silicon nitride layer, wherein the silicon nitride layer is deposited using a BTBAS precursor (par. 70, lines 1-4).

The Wolf et al. non-patent literature patent (Wolf) discloses a method for depositing silicon oxide, wherein the silicon oxide is deposited using TEOS (page 184, lines 35-41).

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to deposit the first nitride layer using a BTBAS and

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depositing the silicon oxide layer using TEOS for reasons as follows: like SiH_4 , BTBAS is a silicon-containing precursor used in chemical vapor deposition processes to form silicon nitride layers; and TEOS is decomposed in medium temperature range chemical vapor deposition processes to form silicon oxide layers.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toniae M. Thomas whose telephone number is (571) 272-1846. The examiner can normally be reached on Monday through Friday from 8:30 a.m. to 5:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on (571) 272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TMT
09 November 2005



Mary Wilczewski
Primary Examiner